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NATIONAL DAM SAFETY PROGRAM. KITTATINNY LAKE DAM (NJ-00265), DE--ETC(U)
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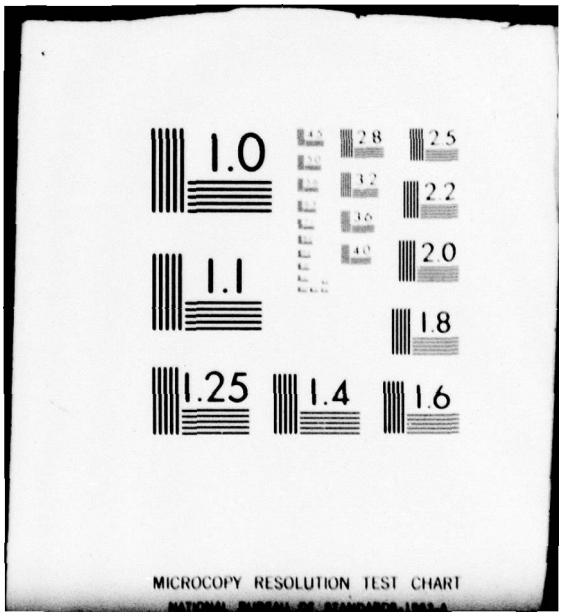
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DELAWARE RIVER BASIN
FLAT BROOK, SUSSEX COUNTY
NEW JERSEY

LEVEL II

KITTATINNY LAKE DAM

NJ 00265

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

DEPARTMENT OF THE ARMY
Philadelphia District
Corps of Engineers
Philadelphia, Pennsylvania

June, 1979

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER: NJ00265
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National Dam Safety Program
Kittatinny Lake Dam
Sussex County, N.J.

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7. AUTHOR(s): (10) F. Keith Jolls / Jolls

8. CONTRACT OR GRANT NUMBER(s): (15) DACW61-79-C-0011

9. PERFORMING ORGANIZATION NAME AND ADDRESS:
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100 Halstead St.
East Orange, N.J.

10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS: (12) 57p.

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Custom House, 2d & Chestnut Streets
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Approved for public release; distribution unlimited.

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(6) National Dam Safety Program. Kittatinny Lake Dam (NJ-00265), Delaware River Basin, Flat Brook, Sussex County, New Jersey. Phase I Inspection Report.

18. SUPPLEMENTARY NOTES

Copies are obtainable from National Technical Information Service, Springfield, Virginia, 22151.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Dams
Spillway
Structural Analysis
Kittatinny Lake Dam NJ
National Dam Inspection Act Report

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report cites results of a technical investigation as to the dam's adequacy. The inspection and evaluation of the dam is as prescribed by the National Dam Inspection Act, Public Law 92-367. The technical investigation includes visual inspection, review of available design and construction records, and preliminary structural and hydraulic and hydrologic calculations, as applicable. An assessment of the dam's general condition is included in the report.

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
CUSTOM HOUSE—2D & CHESTNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

IN REPLY REFER TO

NAPEN-D

Honorable Brendan T. Byrne
Governor of New Jersey
Trenton, NJ 08621

17 SEP 1979

Dear Governor Byrne:

Inclosed is the Phase I Inspection Report for Kittatinny Lake Dam in Sussex County, New Jersey which has been prepared under authorization of the Dam Inspection Act, Public Law 92-367. A brief assessment of the dam's condition is given in the front of the report.

Based on visual inspection, available records, calculations and past operational performance, Kittatinny Lake Dam, initially listed as a high hazard potential structure, but reduced to a low hazard potential structure as a result of this inspection, is judged to be in fair overall condition. The dam's spillway is considered inadequate since 8 percent of the Spillway Design Flood--SDF - would overtop the dam. (The SDF, in this instance, is the One Hundred Year Flood.) The following remedial actions could be undertaken:

a. Rebuild the dam crest and study methods for economical protection of the lakeside face of embankment to retard further erosion.

b. The trees along the shoreline should have their exposed root systems protected with dry stone walls and backfill.

c. Establish an inspection program whereby any further deterioration could be noted and corrective measures be undertaken.

A copy of the report is being furnished to Mr. Dirk C. Hofman, New Jersey Department of Environmental Protection, the designated State Office contact for this program. Within five days of the date of this letter, a copy will also be sent to Congressman James A. Courter of the Thirteenth District. Under the provision of the Freedom of Information Act, the inspection report will be subject to release by this office, upon request, five days after the date of this letter.

NAPEN-D
Honorable Brendan T. Byrne

Additional copies of this report may be obtained from the National Technical Information Services (NTIS), Springfield, Virginia 22161 at a reasonable cost. Please allow four to six weeks from the date of this letter for NTIS to have copies of the report available.

An important aspect of the Dam Safety Program will be the implementation of the recommendations made as a result of the inspection. We accordingly request that we be advised of proposed actions taken by the State to implement our recommendations.

Sincerely,

JOEL T. CALLAHAN
Lieutenant Colonel, Corps of Engineers
Acting District Engineer

1 Incl
As stated

Copies furnished:
Dirk C. Hofman, P.E., Deputy Director
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CN029
Trenton, NJ 08625

John O'Dowd, Acting Chief
Bureau of Flood Plain Management
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CN029
Trenton, NJ 08625

KITTATINNY LAKE DAM (NJ00265)

CORPS OF ENGINEERS ASSESSMENT OF GENERAL CONDITIONS

This dam was inspected on 30 April 1979 by Louis Berger & Associates, Inc. under contract to the State of New Jersey. The State, under agreement with the U.S. Army Engineer District, Philadelphia, had this inspection performed in accordance with the National Dam Inspection Act, Public Law 92-367.

Kittatinny Lake Dam, initially listed as a high hazard potential structure, but reduced to a low hazard potential structure as a result of this inspection, is judged to be in fair overall condition. The dam's spillway is considered inadequate since 8 percent of the Spillway Design Flood--SDF - would overtop the dam. (The SDF, in this instance, is the One Hundred Year Flood.) The following remedial actions could be undertaken:

a. Rebuild the dam crest and study methods for economical protection of the lakeside face of embankment to retard further erosion.

b. The trees along the shoreline should have their exposed root systems protected with dry stone walls and backfill.

c. Establish an inspection program whereby any further deterioration could be noted and corrective measures be undertaken.

APPROVED: Joel T. Callahan

JOEL T. CALLAHAN
Lieutenant Colonel, Corps of Engineers
Acting District Engineer

DATE: 13 September 1979

PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM

Name of Dam Kittatinny Lake Dam Fed ID# NJ 00265
NJ ID# 52

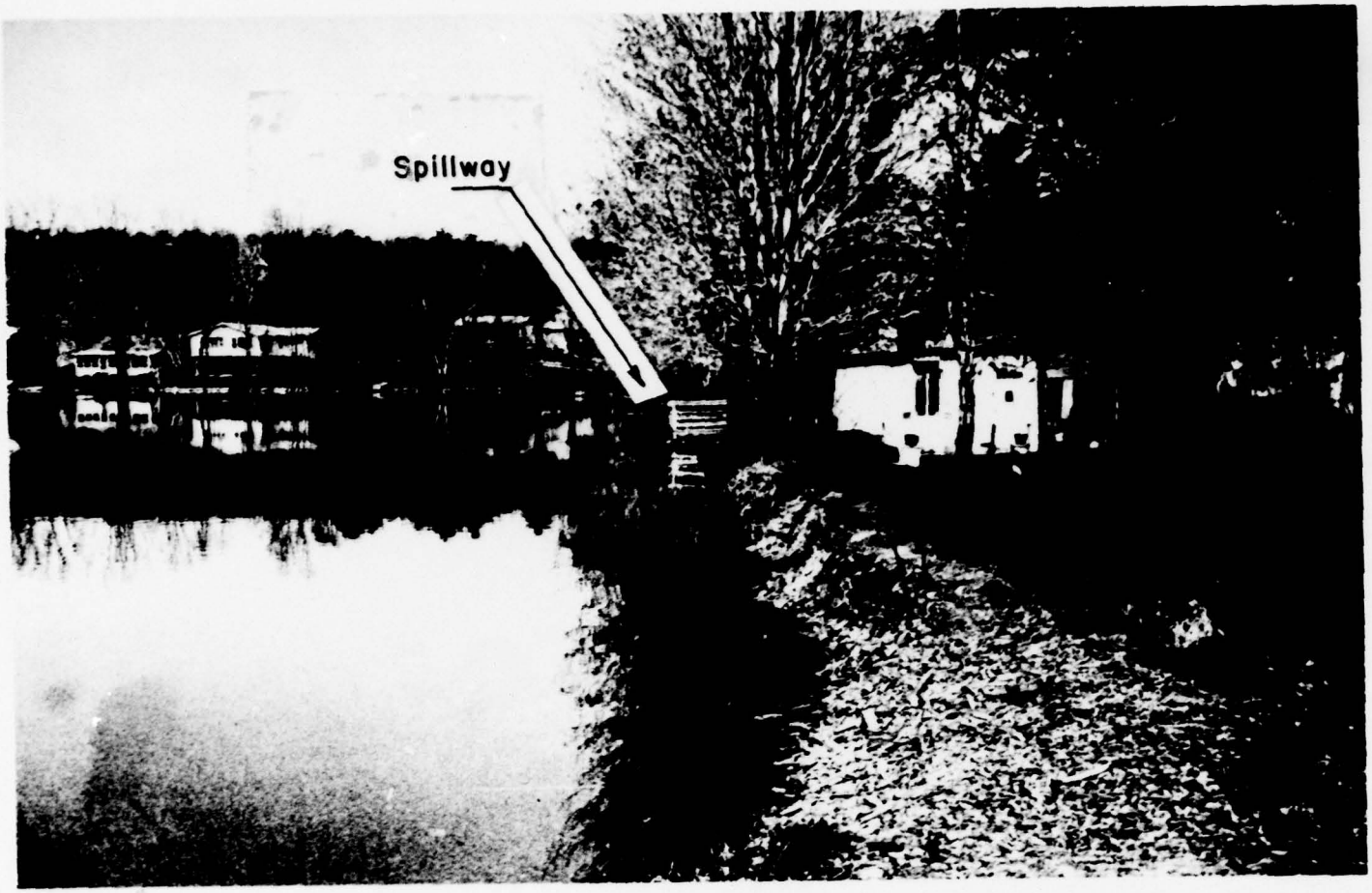
State Located New Jersey
County Sussex
Coordinates Lat. 4110.7 - Long. 7447.6
Stream Tributary Flat Brook
Date of Inspection 30 April 1979

ASSESSMENT OF GENERAL CONDITIONS

Kittatinny Lake Dam is assessed to be in a fair overall structural condition and it is recommended to be downgraded to a low hazard category. Overtopping of the dam would not significantly increase the danger of property damage or loss of life. No detrimental findings were uncovered to merit further study, either of a structural or hydraulic nature although the spillway can accommodate only 7% of the design flood.

Recommended remedial actions to be undertaken in the future include 1) rebuilding the dam crest and protecting the lakeside slope against wave action and 2) building tree walls around the existing trees on the dam crest.

F. Keith Jolls, P.E.
Project Manager



OVERVIEW OF KITTATINNY LAKE DAM

APRIL, 1979

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FIGURES

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
NAME OF DAM: KITTATINNY LAKE DAM FED #NJ 00265
AND NJ ID #52

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority

This report is authorized by the Dam Inspection Act, Public Law 92-367, and has been prepared in accordance with Contract FPM-36 between Louis Berger & Associates, Inc. and the State of New Jersey and its Department of Environmental Protection, Division of Water Resources. The State, in turn, is under agreement with the U.S. Army Corps of Engineers, Philadelphia to have this inspection performed.

b. Purpose of Inspection

The purpose of this inspection is to evaluate the structural and hydraulic condition of Kittatinny Lake Dam and appurtenant structures, and to determine if the dam constitutes a hazard to human life or property.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances

Kittatinny Lake Dam is a 450 foot long earthen structure with a concrete sluiceway outlet located near the left abutment. The dam is situated parallel to Route 206 which lies about 125 feet to the north of the dam crest. At this location, Route 206 is about one foot lower in elevation than the dam crest and the area between the crest and the highway has been backfilled to a level just below the dam crest. There are several summer residences and retail establishments located in this flat area between the highway and the dam. The present dam was constructed on top of an earlier dam.

b. Location

The dam is located on a tributary to Flat Brook in Sandyston Township, Sussex County and is 3 miles northeast of Branchville. It is approximately 1,500 feet west of the village of Culvers Gap on Culver Lake. The historic Appalachian Trail lies on the ridge of Kittatinny Mountain above the east shore of the lake.

c. Size Classification

The dam at Kittatinny Lake has a maximum height of 10 feet and a maximum storage capacity of 373 acre-feet. Accordingly, this dam is in the small size category as defined by the criteria in the Recommended Guidelines for Safety Inspection of Dams (storage less than 1,000 acre-feet).

d. Hazard Classification

Kittatinny Lake is surrounded by Stokes State Forest which is essentially an undeveloped area. There are, however, several summer homes and year round retail establishments located on the backslope of the dam as well as along U.S. Route 206. Since the highway is slightly below the dam crest, a breach or failure could damage the homes and businesses immediately below the dam. It is most probable that the damage would only be minimal. Therefore, in view of the hydraulic differential, it is recommended that this dam be downgraded to the low hazard classification.

e. Ownership

This dam is owned by the Kittatinny Lake Association, Sandyston Township, Sussex County, New Jersey.

f. Purpose of Dam

The purpose of the dam is to impound a recreation lake.

g. Design and Construction History

Kittatinny Lake Dam was designed and constructed in 1923. The design engineer was

Snook & Hardin of Newton, New Jersey and the construction was accomplished under the auspices of Edward McGuinness of the Essex & Sussex Development Co., Newark, the owners at that time. The dam crest was raised 18 inches in 1924 in accordance with revised plans prepared by the design engineer. Continual maintenance and remedial work is provided by the present owners, the Kittatinny Lake Association.

h. Normal Operating Procedures

The dam is continually monitored by resident members of the lake Association and its maintenance committee. Maintenance is performed on an as-needed basis and a member of the maintenance committee is assigned to remove the stop logs whenever a rise in the lake elevation is anticipated due to heavier than normal rainfall.

1.3 PERTINENT DATA

a. Drainage Area

Kittatinny Lake Dam has a drainage area of 1.1 square miles which consists primarily of woodland, State forest, and residential development in the immediate vicinity.

b. Total spillway capacity at maximum pool elevation - 46 cfs

c. Elevations (ft. above MSL)

Top of dam - 910
Principal spillway crest (gated) - 908.5
Streambed at centerline of dam - 900 ±

d. Reservoir

Length of maximum pool (top of dam) - 4,600 feet

Length of recreation pool (principal spillway crest) - 4,450 feet

e. Storage (acre-feet)

Top of dam - 373
Recreation pool - 246

f. Reservoir Surface (acres)

Top of dam - 87
Recreation pool - 82

g. Dam

Type - Earth with concrete spillway

Length - 450 feet

Height - 10 feet

Top Width - 12± feet (varies)

Side Slopes - Variable

Zoning - Unzoned

Impervious Core - Unknown (see Section 3.1.b)

Cutoff - Unknown

Grout curtain - None

h. Diversion and Regulating Tunnel - None

i. Spillway

Type - Concrete weir with gated sluiceway
Length of weir - 8 feet
Sluiceway width - 2 feet
Gates - Stop logs
D/S Channel - Straight stone bottomed channel with masonry sidewalls.

j. Regulating Outlets - None

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

Little design information was available to the inspection team for the evaluation of this dam. The dam was designed, and construction started in 1923 without the knowledge of the State Department of Conservation and Development. The original design plans are not within the State files although records of communication between the developer's agent and the State's engineers during construction provided some information concerning the dimensions of the dam and spillway as well as a general description of the embankment material.

2.2 CONSTRUCTION

The above cited microfilm files indicates that prior to the completion of construction, the developer requested and received permission to increase the height of the dam by 1.5 feet. There are no as-built construction drawings available that reflect this. However, field measurements of the spillway structure indicate that the approved height change was incorporated during the final construction stages.

2.3 OPERATION

There is no information available with respect to operations at this dam other than verbal communication with members of the Kittatinny Lake Association (see Section 4).

2.4 EVALUATION

a. Availability

Insufficient information was available to assess the original design assumptions, hydraulic and hydrologic criteria or stability. However, information pertaining to changes made during construction and verified in the field, provided the inspection team sufficient detail to evaluate stability and hydraulic capacity of the spillway. Although nothing could be ascertained regarding the foundations, the dam

is situated in a narrow valley formed at the foot of Kittatinny Mountain. The soils in this region are of glacial origin. The overburden adjacent to the dam consists of a small pocket of stratified drift with the underlying bedrock consisting of shale and sandstone.

b. Adequacy

In view of the present condition of the dam and its modest height, the design information obtained is considered adequate to perform an evaluation and the following assessment.

c. Validity

The validity of the negligible engineering design data available is not challenged and is accepted as it is not particularly germane to the evaluation (See Section 6).

SECTION 3 - VISUAL INSPECTIONS

3.1 FINDINGS

a. General

Visual inspection of Kittatinny Lake Dam was held on April 30, 1979 with members of the Kittatinny Lake Association, who related what information they had pertaining to the history of the dam and development in the area. They also reviewed various maintenance problems and remedial actions performed by the association. The embankment was considered to be in a poor overall condition from an engineering standpoint although it appears extremely stable with little possibility of seepage problems due to the complete obliteration of the downstream slope of the embankment.

b. Dam

The present configuration of the embankment crest has changed radically from descriptions of the original design. The entire downstream slope area has been filled in from the dam crest to Route 206 and several summer homes and two commercial establishments have been constructed on the manmade fill. It appears the refilling operation was done soon after the initial construction. Several large diameter trees grow along the crest and several small docks have been built out into the lake. Wave action has eroded several feet of the upstream edge of the entire crest. In an effort to suppress the continuing erosion, the lake association placed 800 tons of broken shale and clay along the crest in the fall of 1977. However, the clay immediately washed out and the shale material settled and slid down the face of the embankment leaving the leading edge of the crest in its prior state. The long-term erosion has carried away the original lakeside edge of crest berm until it is now within three feet of the back edge. Several of the large trees on the crest are now right at the waterline. However, the portion of the embankment near the spillway structure has maintained its original shape and position.

At the right end of the embankment, the top of a concrete wall is exposed a few feet below the water surface and extends parallel to the dam axis. The origin of this wall is unknown and appears to be a lake front retaining or seawall, built at some earlier time. There are no records that this is a corewall in the historical data and its depth and limits are unknown.

At the left end of the dam there is a slight saddle which extends to the abutment/embankment junction. The embankment in this location is slightly damp although the owner's representatives believe that this saddle area has never been overtopped (the dampness may be attributed to recent precipitation and the impermeability of the clayey soil).

c. Appurtenant Structures

The concrete sluiceway is located about 120 feet from the left abutment. The exposed tops and sides of the wingwalls show light spalling and surfacial cracking but, overall, its condition is satisfactory. At the time of inspection, stoplogs were in place up to elevation 908.5 and about 2 inches of water was passing over the crest. The concrete slabs located between the retaining walls on both sides of the weir were badly spalled but these do not appear to be structural and are of minor consequence to the integrity of the structure. A fish screen has been placed across the weir in front of the stoplogs. The embankment crest has been eroded at the ends of both upstream retaining walls but is not as severe here as it is along the remainder of the dam.

d. Reservoir Area

Kittatinny Lake is roughly rectangular in shape with an average width of about 900 feet and a length of about 4,600 feet. The shoreline is dotted with summer and year-round residences. The walls of the valley in which the lake is situated rise steeply to elevations between 250 and 450 feet above the level of the lake. With the exception of the residences immediately around the lake, the drainage area is completely undeveloped as it is bounded by Stokes State

Forest and the rugged Kittatinny Mountain. Due to the prevailing westerly winds and the topographic barrier formed by Kittatinny Mountain air movements tend to move in a northerly direction and produce fairly severe wave action at the north end which accounts for much of the long term destruction of the dam crest. Additionally, the greatest amount of organic debris and sedimentation occurs in the vicinity of the dam.

e. Downstream Channel

The downstream channel between the dam and U.S. Route 206 is straight and clear with low masonry sidewalls. The side slopes are generally well groomed and clear of obstructions. At Route 206 the brook passes through a 6' x 10' concrete box culvert under the highway and enters an undeveloped marsh and woodland area which is part of Stokes State Forest. Two thousand feet below the dam, the channel enters into a rather narrow, steep sided gorge and continues as such until it reaches Tuttles Corner, about 2 miles downstream. Below these, it joins the wider and flatter flood plain of the main headwaters of Flat Brook.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

Kittatinny Lake Dam was designed and constructed solely for the purpose of creating a recreational lake. Presently, there are few formal operational procedures but the dam is monitored frequently (but on an informal basis) by members of the Lake Association who represent a concerned group of local residents. They are aware of deficiencies at the dam and are attempting to rectify serious problems although hampered by limited funds. In addition to inspections, the members perform light maintenance as well as adjustment of the lake level by use of the stop-logs in the spillway. The lake is lowered several feet each fall in order to mitigate ice damage and permit repairs to private docks and the dam itself. The only other time the stop logs are removed is during heavy storms. This, however, is also an informal process dependent upon the judgement of the Association members.

4.2 MAINTENANCE OF DAM

The dam is maintained by a committee of members who perform light remedial work and groundskeeping. Their attempt to halt the erosion of the dam crest has been on going for several years and is their primary concern at the present time. The corrective measures attempted in 1977 have, unfortunately, proven less than completely satisfactory.

4.3 DESCRIPTION OF ANY WARNING SYSTEM

No formal warning system exists at the dam although it is frequently monitored by members of the association during periods of heavy flows and storm conditions.

4.4 EVALUATION OF OPERATIONAL ADEQUACY

While the extent of the operational procedures appears adequate for a recreational lake, it is felt that they should be conducted somewhat more systematically in view of the present condition of the dam embankment. Since there is only 1.5 feet of freeboard between normal pool and the top of the dam, it could prove beneficial to develop a more systematic approach to determining

the necessity for stop log removal during storms. A formal warning system is not considered necessary at this dam in view of its hazard classification and size.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

a. Design Data

Based on the criteria in the Recommended Guidelines for Safety Inspection of Dams, the 100-year frequency event was selected as the design storm by the inspecting engineer. Precipitation data was obtained from Technical Paper 40 and NOAA TM NWS Hydro 35. Inflow to the reservoir for the design storm was computed utilizing the HEC-1 computer program. This gave a peak inflow into the reservoir of 2,674 cfs with subsequent routing through the reservoir reducing the peak to 635 cfs. The spillway has a maximum discharge capacity of approximately 46 cfs before overtopping occurs and can therefore accommodate only 7% of the design flood.

b. Experience Data

The dam was originally designed for a 1.5 foot freeboard according to records but no design calculations were available.

c. Visual Observations

The lake level was at normal pool at the time of inspection, with a substantial amount of water flowing over the weir.

d. Overtopping Potential

There are no records of the dam having been overtopped according to local residents. However, it appears that the low saddle area near the left abutment would act as an auxiliary spillway. The saddle, which is approximately 30 feet long and ½ foot lower than the rest of the dam crest, is part of a gravel covered parking lot at the left end of the embankment. The design storm would overtop the dam crest by less than one foot.

e. Drawdown Potential

Removing the stop logs to the bottom of the spillway (to El. 900.8), it would take approximately 4½ days to draw the reservoir down. There is an abandoned 12" tile drain below the weir but it is completely plugged and the entrance buried.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION

a. Visual Observations

Although the lakeside edge of the dam crest has eroded completely away from its original configuration, the substantial backfilling of the downstream area all the way over to the Route 206 roadway fill has placed the embankment in a minor role as far as its structural stability and permeability. The numerous large trees along the crest (right at the water-line) are actually helping to stabilize the crest and prevent further erosion due to wave action. The principal concern of the inspection team was a possible breaching immediately to each side of the spillway but all discharges in these zones would dump directly into the well-defined downstream channel leading under Route 206. The concrete spillway is in satisfactory condition commensurate with its age.

b. Design and Construction Data

Although little design or construction information was available, the dam appears to have been originally well-engineered although the spillway has a very small discharge capacity (46 cfs) when compared to the DOT box culvert immediately downstream (600 $\pm$ cfs). It was noted that this culvert has approximately the same capacity as the design flood.

c. Operating Records

The performance of the dam has been satisfactory since its installation although the lakeshore erosion along the crest appears to have been a long-term, continuous maintenance problem.

d. Post Construction Changes

There have been no major modifications since the initial construction except for the additional fill which was placed on the lake-side slope in 1977.

e. Seismic Stability

The dam is located in Seismic Zone 1 and due to this and its low height, has negligible potential vulnerability to seismic loadings. Experience indicates dams in Zone 1 will have adequate stability under dynamic loading conditions if stable under static loading conditions. As indicated in Section 3.1-a, this dam appears extremely stable since the entire downstream area has been filled into crest elevation.

SECTION 7 - ASSESSMENTS/RECOMMENDATIONS/ REMEDIAL ACTIONS

7.1 DAM ASSESSMENT

a. Safety

Subject to the inherent limitations of the Phase I visual inspection, Kittatinny Dam is judged to be in a fair overall condition. Collapse of the dam due to overtopping is a very remote possibility and no seriously detrimental conditions were observed although the spillway can accommodate only 7% of the design flood. Breaching of the embankment crest could inflict property damage on the buildings below the dam but there is no danger of collapse whereby human life would be endangered. Therefore it is recommended that the dam be reclassified in the low hazard category.

b. Adequacy of Information

The available information is believed to be adequate regarding the analyses and evaluation of safe operation and structural stability.

c. Urgency

No immediate urgency is attached to implementing further studies or the remedial measures set forth below.

d. Necessity for Further Study

In view of the overall condition of this dam, additional inspections under the purveiw of P.L. 92-367 are deemed to be unnecessary.

7.2 RECOMMENDATIONS/REMEDIAL MEASURES

a. Recommended Actions

It is recommended that the following be taken under advisement in the future:

- Study methods for economical protection of the lakeside face of embankment to retard further erosion. Consideration could be given to hand placed riprap stones or a low masonry seawall.

- The trees along the shoreline should have their exposed root systems protected with dry stone walls and backfill.

b. O&M Maintenance and Procedures

In view of the assessment contained herein, no additional procedures other than those presently undertaken appear to be required. However, the Association should establish an inspection program whereby any futher deterioration could be noted and corrective measures be undertaken.

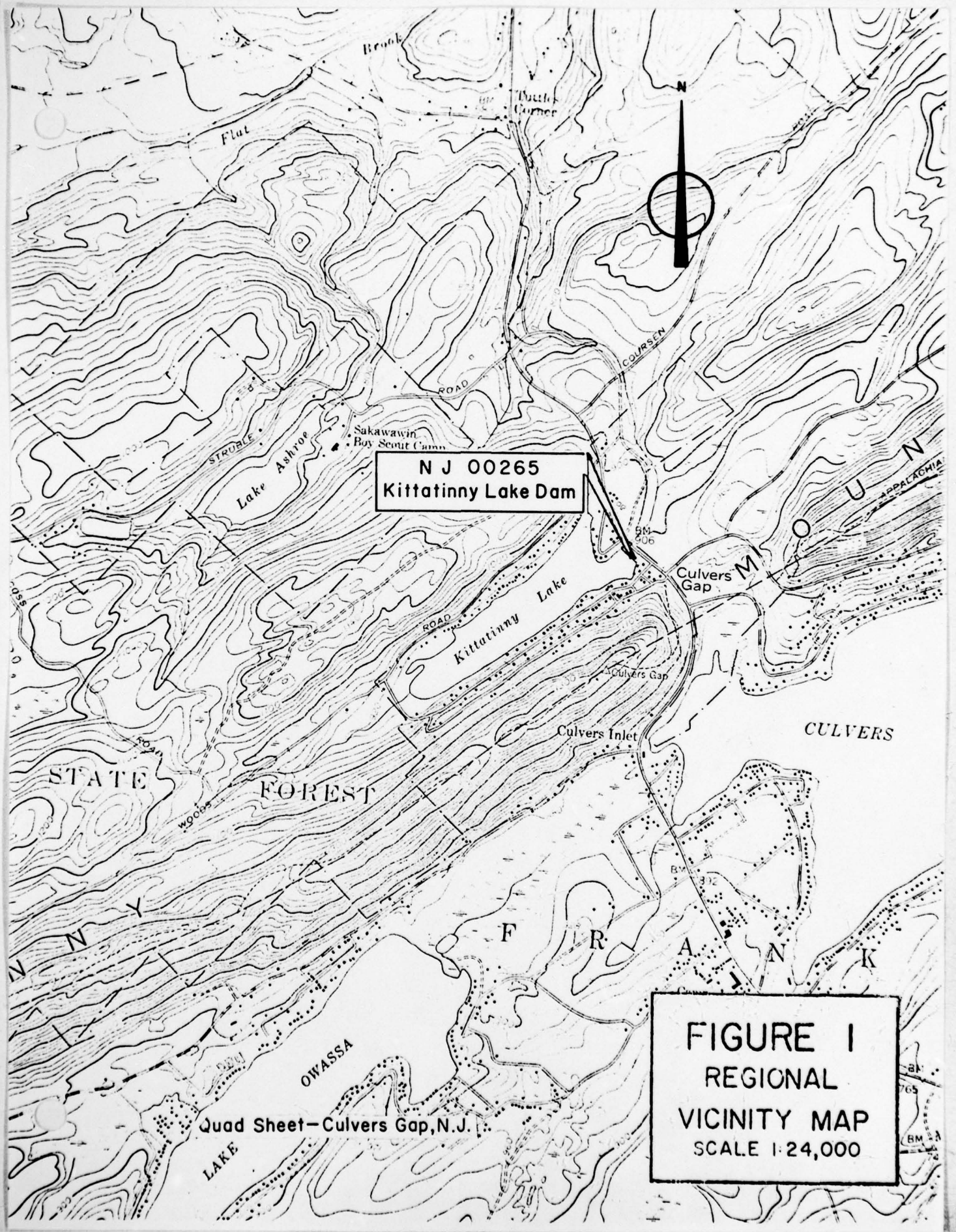
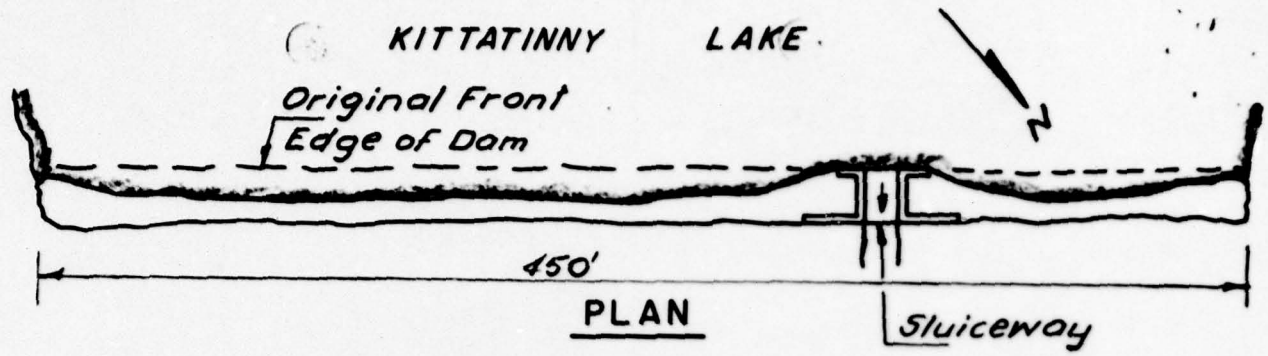
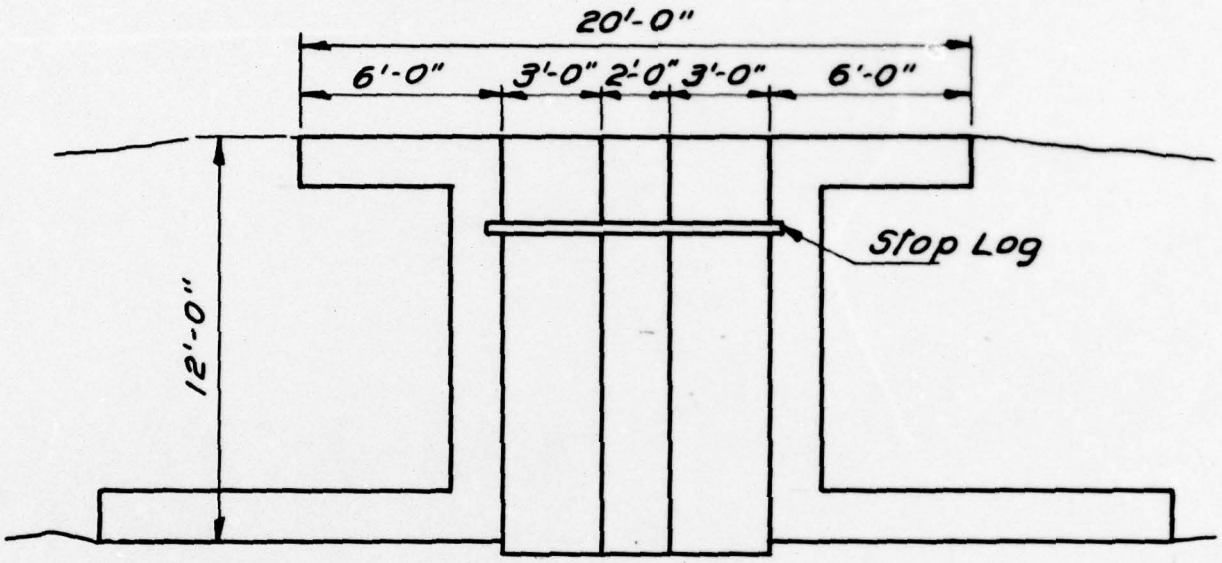


FIGURE 1
REGIONAL
VICINITY MAP
SCALE 1:24,000

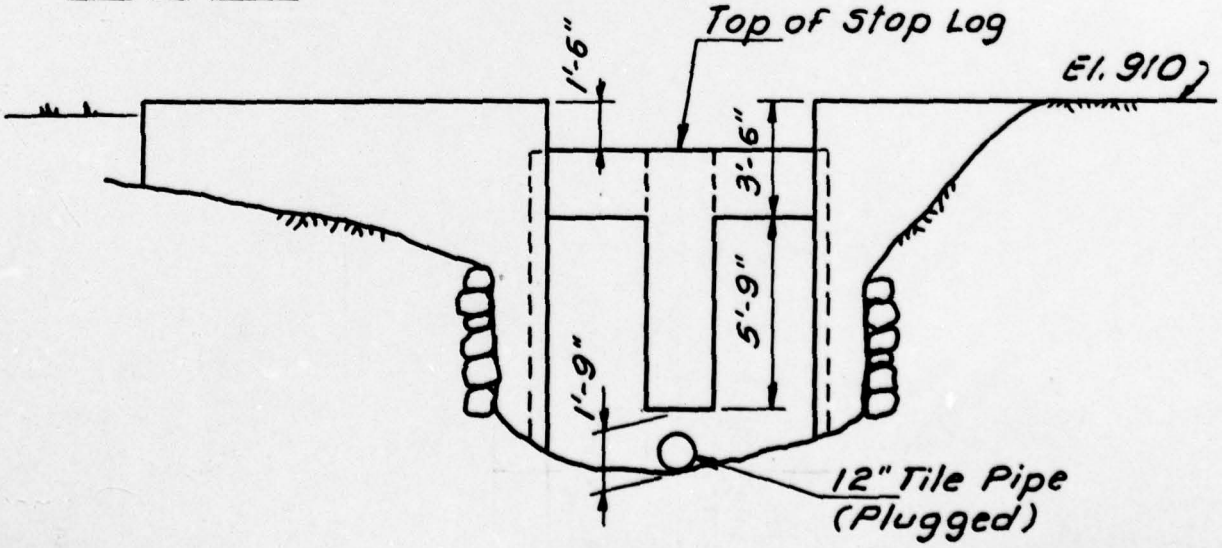


PLAN



SLUICEWAY PLAN

Not to Scale



OUTLET ELEVATION

FIGURE 2

Check List
Visual Inspection
Phase 1

Name Dam Kittatinny Lake Dam County Sussex State New Jersey Coordinators NJDEP

Date(s) Inspection 4/30/79 Weather Clear Temperature 65°

Pool Elevation at Time of Inspection 909 M.S.L. Tailwater at Time of Inspection 900 M.S.L.

Inspection Personnel:

Chapter (LBA) Hirsch (KLA) Helmstetter (KLA)

Carter (Raamot) Pinyone (KLA) Swaszek (KLA)

Greenfield (Raamot) K. Jolls

T. Chapter Recorder

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None observed	Embankment geometry obliterated by filling and house-building on dam.
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	No toe as such; embankment extends from crest to highway 125' downstream.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Upstream face eroding from wave action.	Face should be refilled and protected with riprap.
VERTICAL AND HORIZONTAL ALINEMENT OF THE CREST	Swale at left abutment somewhat wet (minor)	
RIPRAP FAILURES	N/A	Some exposed stone under water on shoreline.

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
EXCESSIVE SHRUB GROWTH, TREES, ETC.	Large trees along entire embankment; some in danger of being undercut by wave action.	Circular walls should be built around trees.
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Right abutment upstream face eroded. Core wall visible.	Note: Plans do not indicate presence of a corewall.
ANY NOTICEABLE SEEPAGE	None	
STAFF GAGE AND RECORDER	None	
DRAINS	None	

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	Spalling on surface of spillway structure	
INTAKE STRUCTURE	None	
OUTLET STRUCTURE	None	
OUTLET CHANNEL	Good; clear and straight; Route 206 road culvert has a 6' x 10' opening (built in 1929).	Channel sides are masonry and in good condition.
EMERGENCY GATE	Flashboards from sluiceway sill to crest.	

GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	Satisfactory condition; light spalling of concrete sidewalls; some efflorescence.	
APPROACH CHANNEL	None	A fish screen lies across the mouth of the sluiceway. (Lake is stocked annually).
DISCHARGE CHANNEL	Straight and clear with masonry side walls.	
BRIDGE AND PIERS	Route 206 road culvert about 125 feet downstream has a 6' x 10' opening through which the channel passes	A make-shift plank-walk crosses the spillway. It is no hindrance to flow and appears necessary for removal of stop logs.
GATES AND OPERATION EQUIPMENT	Stop log slot extends from the bottom of the sluiceway to the crest; Top 1.5' is never used; Removed manually.	

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Steep slopes on both sides of lake; Many houses along shoreline; Backslope of embankment is flat.	
SEDIMENTATION	Silting in Northeast corner of lake; Some organic debris, leaves, lakeweed, twigs, etc.	Prevailing winds funnel up the lake from south to north driving debris into north east corner of lake and causing heavy erosion and sedimentation at the north end of the lake.

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Clear	Channel and embankment between dam and road bridge in good condition.
SLOPES	Vertical masonry walls about 3' high and 1H:1V/4H:1V slopes on the left and right side of channel respectively.	
APPROXIMATE NO. OF HOMES AND POPULATION	Gas station, 3 summer homes and tavern on embankment backslope; Swamp and state forest on north side of Rt. 206.	Homes slightly below dam crest elevation.

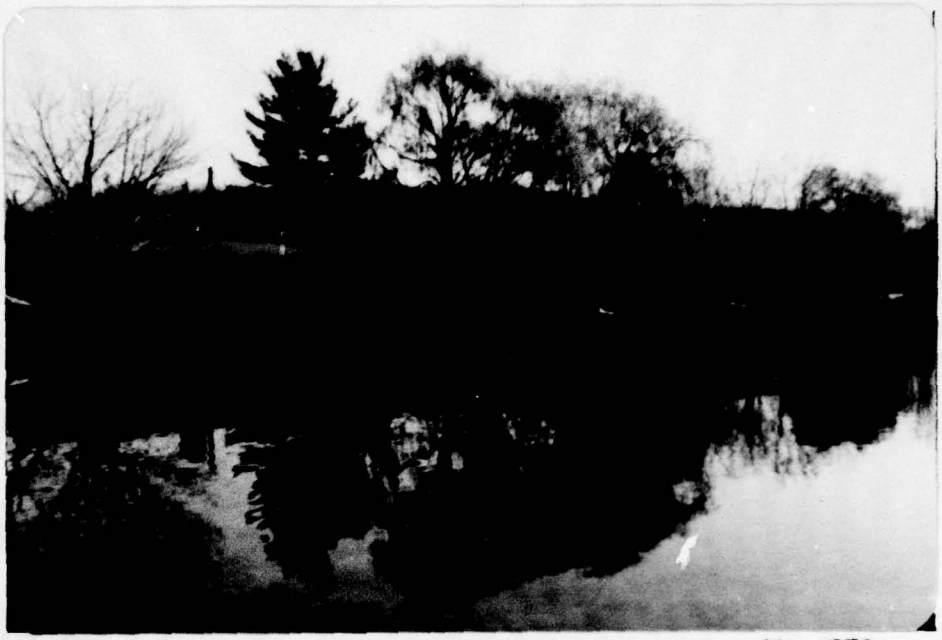
CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
PLAN OF DAM	Not available
REGIONAL VICINITY MAP	USGS Quadrangle - Culver's Gap, N.J.
CONSTRUCTION HISTORY	Sketchy notes available in NJDEP files
TYPICAL SECTIONS OF DAM	Not available
HYDROLOGIC/HYDRAULIC DATA	Not available
OUTLETS - PLAN	Available in NJDEP files
- DETAILS	Unavailable
-CONSTRAINTS	Unavailable
-DISCHARGE RATINGS	Unavailable
RAINFALL/RESERVOIR RECORDS	Unavailable

ITEM	REMARKS
SPILLWAY PLAN	Available in NJDEP files
SECTIONS	Available in NJDEP files
DETAILS	Unavailable - Measured in field
OPERATING EQUIPMENT PLANS & DETAILS	Unavailable - Stop logs measured in field

ITEM	REMARKS
DESIGN REPORTS	Unavailable
GEOLOGY REPORTS	Unavailable
DESIGN COMPUTATIONS	Unavailable
HYDROLOGY & HYDRAULICS	Unavailable
DAM STABILITY	Unavailable
SEEPAGE STUDIES	Unavailable
MATERIALS INVESTIGATIONS	Unavailable
BORING RECORDS	Unavailable
LABORATORY	Unavailable
FIELD	Unavailable
POST-CONSTRUCTION SURVEYS OF DAM	Unavailable
BORROW SOURCES	Unavailable

ITEM	REMARKS
MONITORING SYSTEMS	No automatic system - Monitored continuously by members of the lake association.
MODIFICATIONS	Height of dam raised 18" the year following original construction.
HIGH POOL RECORDS	Unavailable
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	Unavailable
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	Unavailable
MAINTENANCE OPERATION RECORDS	Written record unavailable



Kittatinny Lake Dam

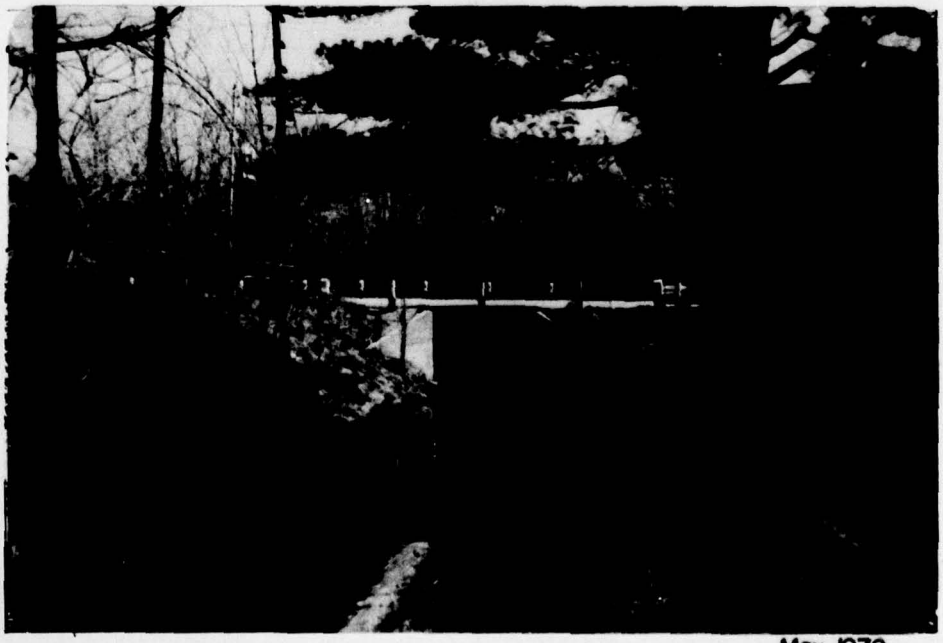
May, 1979

View of Crest Erosion

May, 1979

May, 1979

View of Spillway



May, 1979

View of Discharge Channel

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: 1.13 sq. mi.

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 908.5 (246 acre-feet)

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): N/A

ELEVATION MAXIMUM DESIGN POOL: N/A

ELEVATION TOP DAM: 910

CREST:

a. Elevation 908.5
b. Type Concrete weir with 2 foot wide gated sluiceway
c. Width 12 feet
d. Length 8 feet
e. Location Spillover 120 feet from left abutment
f. Number and Type of Gates Stop logs from El. 901.5 to El. 908.5

OUTLET WORKS: None

a. Type
b. Location
c. Entrance inverts
d. Exit inverts
e. Emergency draindown facilities

HYDROMETEOROLOGICAL GAGES: None

a. Type
b. Location
c. Records

MAXIMUM NON-DAMAGING DISCHARGE: 46 cfs

BY D.J.M. DATE 6-79
CHKD. BY ____ DATE ____
SUBJECT ____

LOUIS BERGER & ASSOCIATES INC.
KITTATINNY LAKE DAM

SHEET NO. A1 OF
PROJECT C234

Time of concentration :

length along watercourse to drainage divide = 1.2 miles
= 6336 feet

$\Delta H = 280'$ Slope $= \frac{280 \times 100}{6336} \simeq 4$ %

Assume velocity of 4.0 ft.s^{-1}

$\therefore t_c = \frac{6336}{4.0 \times 3600} = 0.44$ hours

By California Culverts Method :

$$t_c = \left(\frac{11.9 \times 1.2^3}{280}\right)^{0.385} \simeq 0.4 \text{ hours}$$

By Kirpich's formula :

$$t_c = 0.00012 \times \frac{6336^{0.77}}{0.044^{0.385}} \simeq 0.4 \text{ hours}$$

take $t_c = 0.5$ hours

$$t_p = \frac{0.25}{2} + 0.6 \times 0.5 = 0.43 \text{ hours}$$

$$Q_p = \frac{484 \times 1.1}{0.43} = 1238 \text{ cfs}$$

BY D.J.M. DATE 6-79 | **LOUIS BERGER & ASSOCIATES INC.** | SHEET NO. A2 OF

CHKD. BY ____ DATE ____ | KITTATINNY LAKE DAM | PROJECT C.234

SUBJECT ____

Unitgraph :

Time (hours)	T/Tp	Dimensionless Ordinate (DO)	Q (cfs) = Qp x DO
0.25	0.58	0.56	693
0.50	1.16	0.95	1176
0.75	1.74	0.45	557
1.00	2.33	0.199	246
1.25	2.91	0.084	104
1.50	3.49	0.036	45
1.75	4.07	0.017	21

$\Sigma Q = 2842$

Check :

$$\frac{2842 \times 12 \times 3600}{1.1 \times 5280^2 \times 4} = 1.0008 \approx 1 \text{ so O.K.}$$

BY D.J.M. DATE 5-79 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. A2 OF

CHKD. BY ____ DATE ____ N.J. NORTH DAM INSPECTIONS PROJECT C234

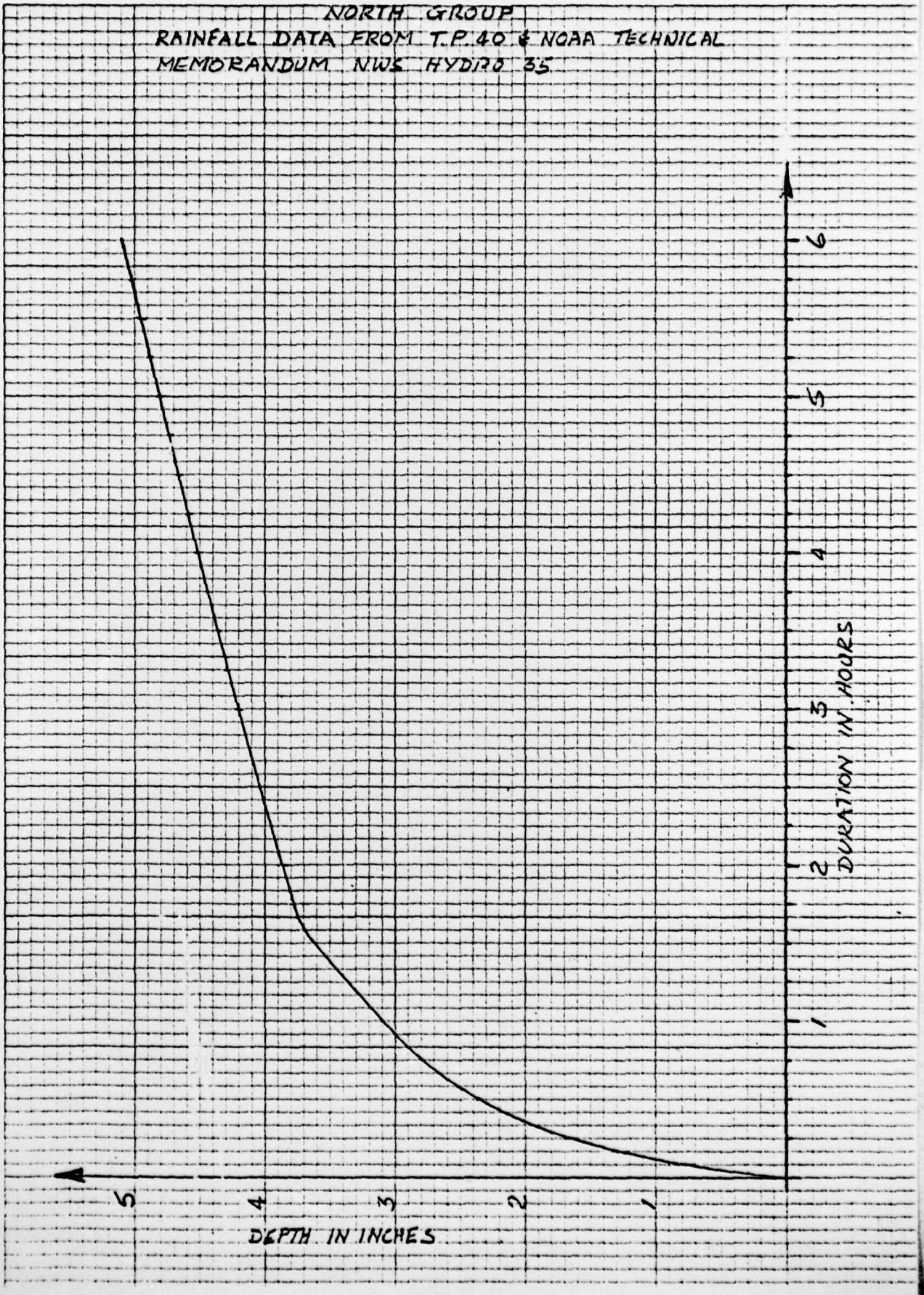
SUBJECT RAINFALL DATA FROM T.P. 40 & NOAA TECH. MEMO. NWS HYDRO 35

100 YEAR FREQUENCY EVENT :

Time (hrs)	Precipitation (inches)	Δ (inches)	Rearrange Δ (inches)
0.25	1.65	1.65	0.07
0.50	2.36	0.71	0.07
0.75	2.80	0.44	0.08
1.00	3.10	0.30	0.08
1.25	3.37	0.27	0.08
1.50	3.61	0.24	0.08
1.75	3.78	0.17	0.08
2.00	3.87	0.09	0.09
2.25	3.96	0.09	0.24
2.50	4.04	0.08	0.30
2.75	4.12	0.08	0.71
3.00	4.20	0.08	1.65
3.25	4.28	0.08	0.44
3.50	4.36	0.08	0.27
3.75	4.44	0.08	0.17
4.00	4.52	0.08	0.09
4.25	4.60	0.08	0.08
4.50	4.68	0.08	0.08
4.75	4.76	0.07	0.08
5.00	4.82	0.07	0.08
5.25	4.89	0.07	0.07
5.50	4.96	0.07	0.07
5.75	5.03	0.07	0.07
6.00	5.10	0.07	0.07

NORTH GROUP

RAINFALL DATA FROM T.P. 40 & NOAA TECHNICAL MEMORANDUM NWS HYDRO 35



BY D. J. M. DATE 6-79
CHKD. BY ____ DATE ____
SUBJECT Spillway discharge capacity

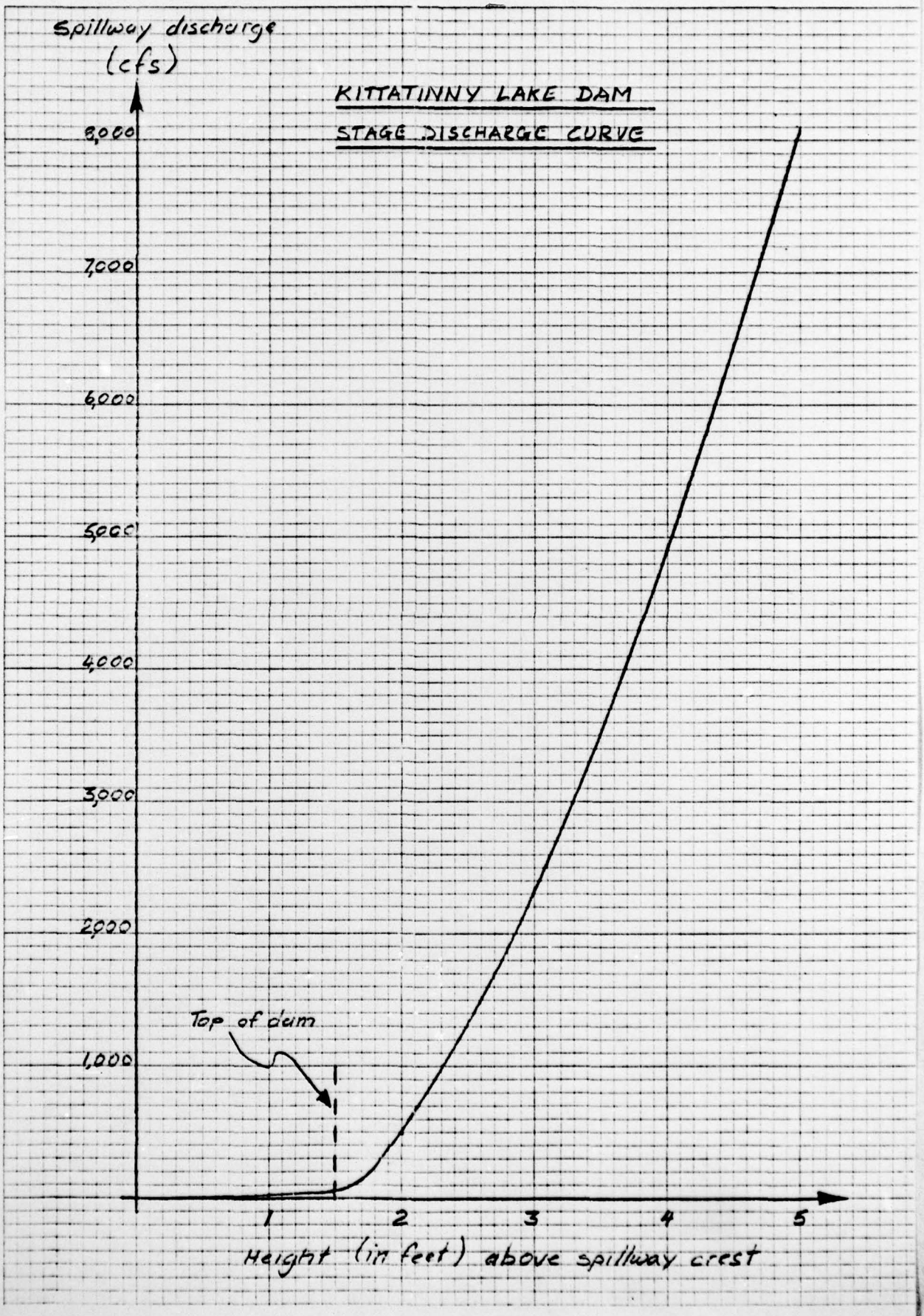
LOUIS BERGER & ASSOCIATES INC.
KITTATINNY LAKE DAM

SHEET NO. ____ OF ____
PROJECT C-234

Spillway discharge:

flow over crest L = 8'			flow over dam L = 442'			ΣQ (cfs)
H	C	Q	H	C	Q	
1	3.1	25				25
1.5	3.1	46				46
2	3.1	70	0.5	2.7	422	492
3	3.1	129	1.5	2.7	2192	2321
4	3.1	198	2.5	2.7	4717	4915
5	3.1	277	3.5	2.7	7814	8091
6	3.1	364	4.5	2.7	11392	11756
7	3.1	459	5.5	2.7	15393	15852
8	3.1	561	6.5	2.7	19777	20338

The above spillway discharge calculations do not include the capacity of the 12" tile pipe which is believed to be inoperable at the present time



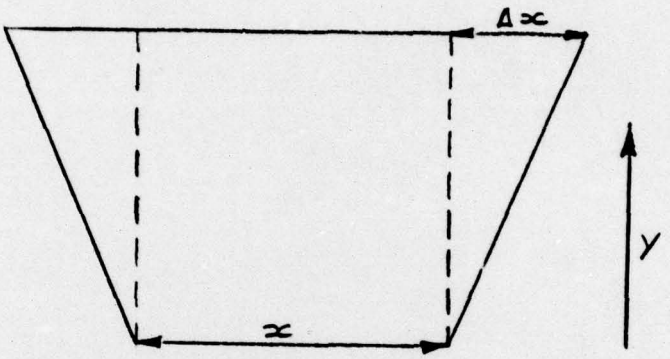
BY D.J.M. DATE 6-79
CHKD. BY ____ DATE ____
SUBJECT ____

LOUIS BERGER & ASSOCIATES INC.
KITTATINNY LAKE DAM

SHEET NO. ____ OF ____
PROJECT C234

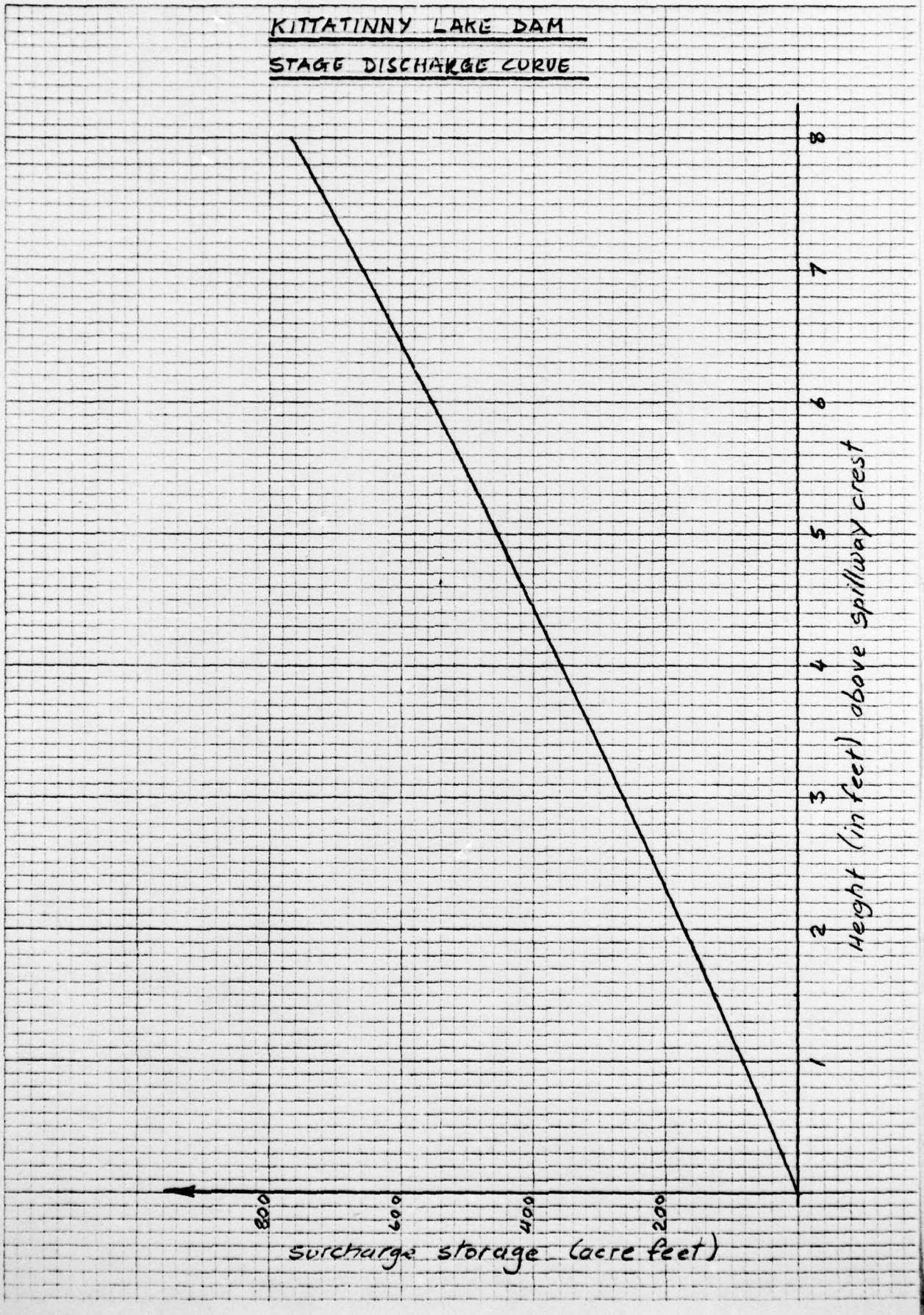
Surcharge storage :

Area of lake @ El. 908.5 = 82 acres
Area of 920' contour = 122 acres
Area of lake @ top of dam = 87 acres



Increment in volume $\Delta V = (x + \Delta x)\, y$

Height in feet above spillway crest	Surcharge storage (acre feet)
0	0
1	84
1.5	127
2	171
3	262
4	356
5	453
6	555
7	659
8	767



BY D.J.M. DATE 6-79 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. ____ OF
CHKD. BY ____ DATE ____ KITTATINNY LAKE DAM PROJECT C-234
SUBJECT Approximate drawdown calculations

Total available head = 7.9 feet

Volume of water = 246 acre feet = 10,715,760 ft.^{3}

Assume drawdown in two stages I) $h = 5.93'$
II) $h = 1.98'$

STAGE I)

$$Q = 2 \times 3 \times 5.93^{1.5} = 87 \text{ cfs}$$

$$\text{time} = \frac{10715760}{2 \times 87 \times 3600}$$

$$= 17.1 \text{ hours}$$

STAGE II)

$$Q = 2 \times 3 \times 1.98^{1.5} = 17 \text{ cfs}$$

$$\text{time} = \frac{10715760}{2 \times 17 \times 3600}$$

$$= 87.6 \text{ hours}$$

$$\Sigma \text{time} = (17.1 + 87.6)/24 = 4.4 \text{ days}$$

Say 4½ days

BY D. J. M. DATE 6-79 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. ____ OF ____
CHKD. BY ____ DATE ____ KITTATINNY LAKE DAM PROJECT C-234
SUBJECT ____

GENERAL SUMMARY OF APPENDIX :

length of spillway @ El. 908.5 = 8 feet
length of dam = 450 feet

Spillway capacity @ top of dam = 46 cfs

Surcharge storage @ top of dam = 127 acre feet
storage @ normal pool = 246 acre feet

∴ Total storage @ top of dam = 373 acre feet

lake area @ normal pool = 82 acres
lake area @ top of dam = 87 acres

Drainage area = 1.1 square miles

KILLALINNY LAKE DAM
BY D.J.M.
JUNE 21 1979

JOB SPECIFICATION

NO	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
100	0	15	0	0	0	0	0	0	0

JOPER NWT
3 0

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

INFLOW TO RESERVOIR

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
1	0	0	0	0	0	1

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
0	-1	1.10	0.0	1.10	0.0	0.0	0	0	0

PRECIP DATA

NP	STORM	DAJ	DAK
24	0.0	0.0	0.0

PRECIP PATTERN

0.07	0.07	0.08	0.08	0.08	0.08	0.08	0.09	0.24	0.30
0.71	1.65	0.44	0.27	0.17	0.09	0.08	0.08	0.08	0.08
0.07	0.07	0.07	0.07						

LOSS DATA

STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0.0	0.0	1.00	0.0	0.0	1.00	0.50	0.10	0.0	0.0

GIVEN UNIT GRAPH. NUHGG= 7

693.	1176.	567.	246.	104.	45.	21.

UNIT GRAPH TOTALS 2842. CFS OR 1.00 INCHES OVER THE AREA

RECESSION DATA

STRTQ= 0.0 QRCSN= 0.0 RTIOR= 1.00

END-OF-PERIOD FLOW

TIME	RAIN	EXCS	COMP Q
1	0.07	0.00	0.
2	0.07	0.00	0.
3	0.08	0.00	0.
4	0.08	0.00	0.
5	0.08	0.00	0.
6	0.08	0.00	0.
7	0.08	0.03	19.
8	0.09	0.06	77.
9	0.24	0.21	241.
10	0.30	0.27	486.

BY DATE
CHKD. BY DATE
SUBJECT

LOUIS BERGER & ASSOCIATES INC.

SHEET NO OF
PROJECT

11	0.71	0.68	937.
12	1.65	1.62	2146.
13	0.44	0.41	2674.
14	0.27	0.24	1771.
15	0.17	0.14	1108.
16	0.09	0.06	660.
17	0.08	0.05	386.
18	0.08	0.05	253.
19	0.08	0.05	184.
20	0.08	0.05	165.
21	0.07	0.05	152.
22	0.07	0.05	138.
23	0.07	0.05	132.
24	0.07	0.05	130.
25	0.0	0.0	97.
26	0.0	0.0	44.
27	0.0	0.0	19.
28	0.0	0.0	8.
29	0.0	0.0	3.
30	0.0	0.0	1.
31	0.0	0.0	0.
32	0.0	0.0	0.
33	0.0	0.0	0.
34	0.0	0.0	0.
35	0.0	0.0	0.
36	0.0	0.0	0.
37	0.0	0.0	0.
38	0.0	0.0	0.
39	0.0	0.0	0.
40	0.0	0.0	0.
41	0.0	0.0	0.
42	0.0	0.0	0.
43	0.0	0.0	0.
44	0.0	0.0	0.
45	0.0	0.0	0.
46	0.0	0.0	0.
47	0.0	0.0	0.
48	0.0	0.0	0.
49	0.0	0.0	0.
50	0.0	0.0	0.
51	0.0	0.0	0.
52	0.0	0.0	0.
53	0.0	0.0	0.
54	0.0	0.0	0.
55	0.0	0.0	0.
56	0.0	0.0	0.
57	0.0	0.0	0.
58	0.0	0.0	0.
59	0.0	0.0	0.
60	0.0	0.0	0.
61	0.0	0.0	0.
62	0.0	0.0	0.
63	0.0	0.0	0.
64	0.0	0.0	0.
65	0.0	0.0	0.
66	0.0	0.0	0.
67	0.0	0.0	0.
68	0.0	0.0	0.
69	0.0	0.0	0.
70	0.0	0.0	0.
71	0.0	0.0	0.

BY D. J.M. DATE 8-79 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. A13 OF

CHKD. BY ______ DATE ______ KITTATINNY LAKE DAM PROJECT C-234

SUBJECT ______

72	0.0	0.0	0.
73	0.0	0.0	0.
74	0.0	0.0	0.
75	0.0	0.0	0.
76	0.0	0.0	0.
77	0.0	0.0	0.
78	0.0	0.0	0.
79	0.0	0.0	0.
80	0.0	0.0	0.
81	0.0	0.0	0.
82	0.0	0.0	0.
83	0.0	0.0	0.
84	0.0	0.0	0.
85	0.0	0.0	0.
86	0.0	0.0	0.
87	0.0	0.0	0.
88	0.0	0.0	0.
89	0.0	0.0	0.
90	0.0	0.0	0.
91	0.0	0.0	0.
92	0.0	0.0	0.
93	0.0	0.0	0.
94	0.0	0.0	0.
95	0.0	0.0	0.
96	0.0	0.0	0.
97	0.0	0.0	0.
98	0.0	0.0	0.
99	0.0	0.0	0.
100	0.0	0.0	0.
SUM	5.10	4.12	11831.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2674.	493.	123.	118.	11830.
INCHES		4.17	4.17	4.17	4.17
AC-FT		245.	245.	245.	245.

HYDROGRAPH ROUTING

ROUTING THROUGH RESERVOIR

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
11	1	0	0	0	0	1

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME
0.0	0.0	0.0	1	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA
1	0	0	0.0	0.0	0.0	0.

STORAGE=	0.	84.	127.	171.	262.	356.	453.	555.	659.	767.
OUTFLOW=	0.	25.	46.	492.	2321.	4915.	8091.	11756.	15852.	20338.

TIME	EOP STOR	AVG IN	EOP OUT
1	0.	0.	0.
2	0.	0.	0.
3	0.	0.	0.
4	0.	0.	0.

5	0.	0.	0.
6	0.	0.	0.
7	0.	10.	0.
8	1.	48.	0.
9	4.	159.	1.
10	12.	364.	4.
11	27.	712.	8.
12	58.	1541.	17.
13	107.	2410.	36.
14	150.	2222.	279.
15	172.	1439.	505.
16	178.	884.	635.
17	176.	523.	596.
18	171.	320.	501.
19	166.	219.	444.
20	161.	175.	393.
21	157.	159.	348.
22	153.	145.	310.
23	150.	135.	277.
24	147.	131.	249.
25	144.	113.	223.
26	142.	71.	194.
27	139.	31.	163.
28	136.	13.	135.
29	133.	5.	110.
30	131.	2.	90.
31	130.	0.	73.
32	128.	0.	59.
33	127.	0.	48.
34	126.	0.	46.
35	125.	0.	45.
36	124.	0.	45.
37	123.	0.	44.
38	123.	0.	44.
39	122.	0.	43.
40	121.	0.	43.
41	120.	0.	43.
42	119.	0.	42.
43	118.	0.	42.
44	117.	0.	41.
45	116.	0.	41.
46	116.	0.	40.
47	115.	0.	40.
48	114.	0.	40.
49	113.	0.	39.
50	112.	0.	39.
51	111.	0.	38.
52	111.	0.	38.
53	110.	0.	38.
54	109.	0.	37.
55	108.	0.	37.
56	108.	0.	37.
57	107.	0.	36.
58	106.	0.	36.
59	105.	0.	35.
60	105.	0.	35.
61	104.	0.	35.
62	103.	0.	34.
63	103.	0.	34.
64	102.	0.	34.
65	101.	0.	33.

66	100.	0.	33.
67	100.	0.	33.
68	99.	0.	32.
69	98.	0.	32.
70	98.	0.	32.
71	97.	0.	31.
72	96.	0.	31.
73	96.	0.	31.
74	95.	0.	30.
75	95.	0.	30.
76	94.	0.	30.
77	93.	0.	30.
78	93.	0.	29.
79	92.	0.	29.
80	92.	0.	29.
81	91.	0.	28.
82	90.	0.	28.
83	90.	0.	28.
84	89.	0.	28.
85	89.	0.	27.
86	88.	0.	27.
87	88.	0.	27.
88	87.	0.	26.
89	86.	0.	26.
90	86.	0.	26.
91	85.	0.	26.
92	85.	0.	25.
93	84.	0.	25.
94	84.	0.	25.
95	83.	0.	25.
96	83.	0.	25.
97	82.	0.	24.
98	82.	0.	24.
99	81.	0.	24.
100	81.	0.	24.
SUM			7933.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	635.	242.	83.	79.	7933.
INCHES		2.05	2.80	2.80	2.80
AC-FT		120.	164.	164.	164.

RUNOFF SUMMARY, AVERAGE FLOW

		PEAK	6-HOUR	24-HOUR	72-HOUR	AREA
HYDROGRAPH AT	1	2674.	493.	123.	118.	1.10
ROUTED TO	11	635.	242.	83.	79.	1.10